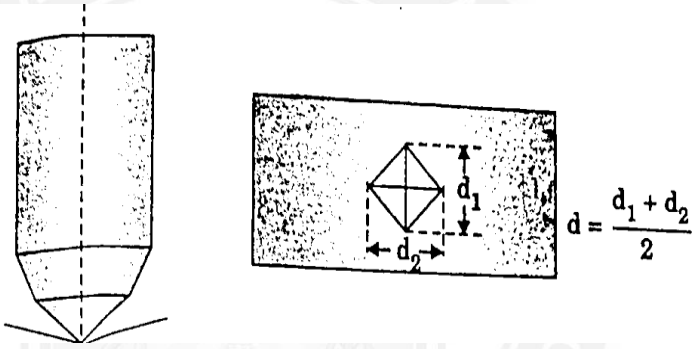
UNIT V MATERIALS TESTNG

5.4 Vickers hardness test

Principle:

A diamond square based pyramid is used as an indenter. It is pressed on the surface of the specimen by applying load for 10-15 secs. Indentation is formed on the surface of the specimen.

Indenter and formula for VHN



Test procedure:

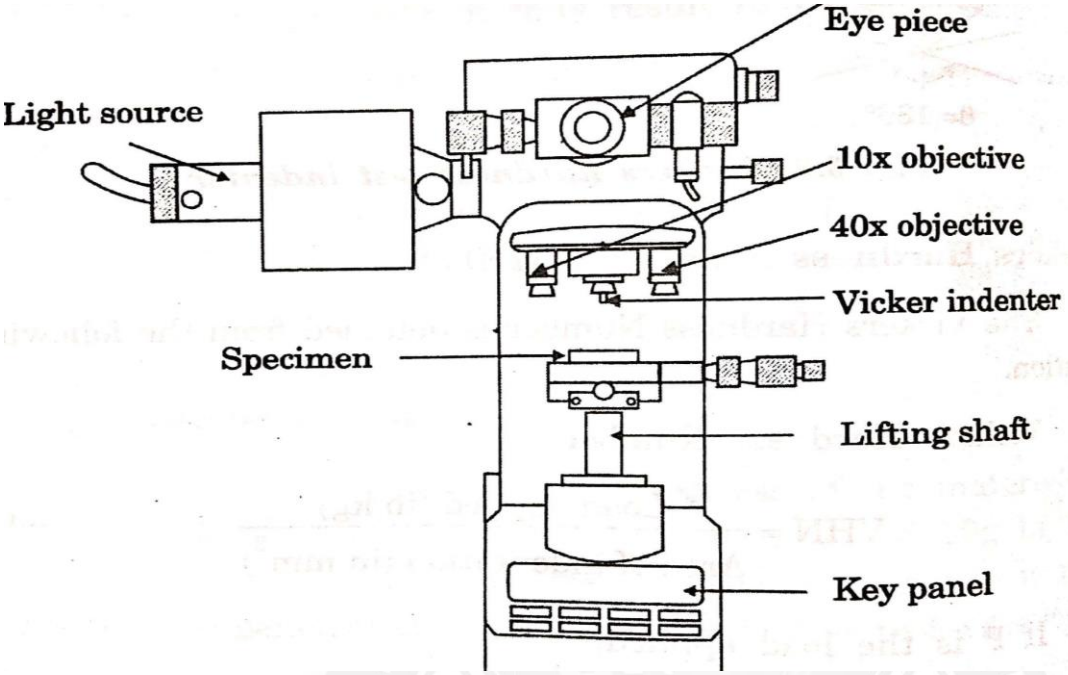
1. The specimen is placed on the anvil.
2. Load is applied and then indenter is pressed on the surface of the sample.
3. Force is maintained for a period 10 t0 15 seconds known as dwell time.
4. The indenter is removed from the sample after the dwell time.
5. Indenter leaves a square indentation.
6. Using the built-**in** optical microscope**,** measure the length of the long diagonal of the indentation
7. Then we can find the hardness number by using formula.

P – load applied

d-diameter of the indentation

Vickers Hardness number

$$VHN = \frac{1.854P}{d^2}$$



Advantages

• Greater precision in measurement compared to spherical ball in Brinell test.

• It can be used for test very hard materials, since diamond is used.

- Can be used for both micro hardness (10 gf to 1 kgf) **and** macro hardness depending on the load.

Disadvantages

- Needs a very smooth and polished surface to get accurate readings
- Slower than Rockwell because of the need for optical measurement of the diagonals.
- On soft or highly reflective surfaces, the diagonal can be hard to measure accurately

Limitations

• Complicated and expensive

• Can be considered for micro hardness testers, since, they cause small size impressions

Comparison between Brinell ,Vickers and Knoop hardness test

Brinell hardness test

It is primarily used for evaluating the hardness of soft to medium-hard materials such as aluminum and cast iron. It employs a steel or tungsten carbide ball as an indentor,

which is pressed into the material surface under a high load, typically ranging from 500 to 3000 kgf. After the indentation is formed, its diameter is measured and used to calculate the material's hardness. This method is ideal for testing bulky specimens and industrial applications like casting and forgings but requires careful surface preparation to ensure accurate results.

Vickers hardness test

It is well-suited for measuring the hardness of very thin materials, coatings, and small objects. It utilizes a diamond pyramid-shaped indentor, which creates an indentation when a low to moderate load (1-120 kgf) is applied. The hardness value is determined by measuring the diagonal lengths of the indentation and using a standard formula. Due to its precision, the Vickers test is often employed in microhardness testing and metallurgical research. However, it requires careful optical measurement and calculations, making it more complex than other hardness tests.

Rockwell hardness test

It is widely used in engineering and industrial applications due to its simplicity and quick results. It measures hardness by determining the depth of an indentation made by either a steel ball or a steel/diamond cone under varying loads (typically 60, 100, or 150 kgf). Unlike Brinell and Vickers, Rockwell provides a direct reading from the testing machine, eliminating the need for detailed measurements and calculations. Its versatility allows testing across a broad range of materials, including metals and polymers, making it a preferred choice for routine quality control.